PART 2: The Permutations Conjecture:

A Variant of the Many Worlds Interpretation of Quantum Mechanics and a Conceptual Framework Linking it to the Block Time Interpretation of General Relativity

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Introduction

This paper will introduce a speculation describing an alternate formulation of Hugh Everett's Many Worlds interpretation; this speculation will be referred to as the *Permutations Conjecture*. It will further itemize a *Conceptual Framework*, within which both Block Time and the Permutations Conjecture fit. The Permutations Conjecture is not directly supported by the current mathematics of quantum mechanics, and it does not, at this time, have any math associated with it. However, the conjecture clearly implies a novel mathematical approach to formulating quantum mechanics, which could optimistically lead to testable hypotheses and maybe to new physics. This is a companion paper to the one entitled PART 1: The Block Time Interpretation of General Relativity.

The Permutations Conjecture takes the position that the mathematics of QM is an excellent approximation, currently in a state similar to the Lorentz transformations before GR – largely constructed empirically, highly predictive, but not explained. This characterization seems fair given the reliance of QM on techniques such as perturbation theory and renormalization using measured values. It proposes that it is because of the operational validity of QM that the Everettian Many Worlds interpretation is evident. However, the implied mathematical approach of the Permutations Conjecture is driven by a concept of Many Worlds from the very outset.

The Permutations Conjecture is not complicated on a superficial level, and will be developed here within the context of the Conceptual Framework, while linking it to Block Time at each step. The five concepts in the framework are: *Dimensionality*, *Morphology*, *Cross Section*, *Observer Bias*, and *Duplicity*.

An Example Permutations Table

Consider a simple permutations table with three dimensions, and three elements in each dimension. Three columns are labeled A, B, and C. Three rows are labeled 1, 2, and 3. At the intersections of these rows and columns are nine individual cells occupied by each possible combination of the letters and numbers, as usual. The additional dimension can be added as layers extending upwards from the page, so to speak. These three layers are labeled Happy Otter, Indifferent Otter, and Sad Otter. All three dimensions together supply a total of twenty seven permutations of letters, numbers, and otter states.

Dimensionality

Special Relativity derives the Lorentz transformations by treating time as a dimension, orthogonal with the three spacial dimensions, and then applying a hyperbolic variant of the Pythagorean theorem. The

concepts of timelike and spacelike curves, and the spacetime continuum suggest a fundamental ontology to the time dimension.

Note that complex numbers are routinely treated as two dimensional, with a real component and an imaginary component within a complex plane. Doing so allows complex numbers to be worked with algebraically using standard trigonometry, even while the imaginary unit (*i*) remains essentially undefined. Sometimes adding dimensions just solves problems. (Except in String Theory, where the new dimensions just curl up and die ;)

The Permutations Conjecture posits that each degree of freedom in a quantum mechanical system is extrapolated within its own orthogonal dimension, as part of an incomprehensibly vast set of dimensions. This includes all possible phase spaces of position and momentum; meanwhile phase spaces are already described in dimensional terms. It also includes all imaginary components of wave functions, or at least something analogous. In the example permutations table above, the letters, numbers, and otter states represent degrees of freedom, and all permutations tables are themselves inherently a set of orthogonal dimensions.

Morphology

In a context of Block Time, it could be considered that the time dimension is not fundamentally different from the spacial dimensions – despite their differences in the math of GR. Instead, the difference can be framed in terms of the world lines of objects; which, for some reason intrinsic to mass-energy, align in timelike curves. The shape, or Morphology, of these world lines – actually manifolds – describes their instantaneous positions and momenta, as well as interactions with the world lines of other objects.

The example permutations table above is expressed in twenty seven discrete cells. It is a conceptually simple matter to continue to subdivide these cells all the way down to infinitesimals, or even just down to discreet increments such as Planck time and Planck length. For the degree of freedom represented by numbers, infinitesimal cells could then represent a scalar field made up of the continuous set of real numbers. Since alphabetical letters are inherently discrete, these could be analogous to steps made in Planck units. For the otter states, one could imagine a set of otter faces morphing continuously from smiling happy otter, through various stages of indifference, on to frowning sad otter. The “tube” resulting from stacking these images, where each cross section of the tube is a two dimensional otter face, best exemplifies the concept of Morphology.

When attempts are made to quantize gravity, the result is often an absurd blossoming of infinities. Oppositely, if the quantum fields are *not* quantized (and renormalized as well), *they* then result in absurd infinities. Perhaps gravity is difficult to quantize because it is indeed not quantum. The Conceptual Framework allows both geometric and quantized Morphologies.

For quanta, the morphology proposed by the Permutations Conjecture might be an actual, physical expression of the wave function. Whether comprised of mass-energy, or being a pure morphology like the strings in String Theory, any individual wave function would comprise a physically extrapolated manifold, eternally real, and residing in as many dimensions as required to account for all of of its degrees of freedom. The geometry of Morphology might include math approaches which do not yet exist, though, so the manifolds of quanta may not necessarily be described by complex-number wave functions as we now know them.

Cross Section

A single instant in time for a macro object is defined by a Cross Section of the World space (Minkowski space), as visualized on a spacetime diagram. In the context of Block Time, each such Cross Section has its own identity, within a progression of similar Cross Sections. To the extent that objects or quanta can be described as three dimensional, such description is limited to a Cross Section of the object's four dimensional world line. Still, the Cross Section has a character all its own, as evidenced by the fact that objects can indeed be meaningfully described as three dimensional.

In the example permutations table, there are primarily three possible systems of Cross Section. The table can be sliced vertically, horizontally, or in layers. A single set of three Cross Sections results in an intersection isolating a single cell, along with the permutation found in that cell. In the Permutations Conjecture, each Cross Section has its own identity in some way; but each intersection of *comprehensive sets* of Cross Sections represents a single World in the Many Worlds sense. A single World (universe), then, is analogous to a single moment in Block Time.

Unlike Everettian Many Worlds, such Worlds within the Permutations Conjecture *do* interact with each other. For example, consider the variation on the double slit experiment where a minimally obtrusive detector is placed on only one of the slits. Let's call the slit with the detector slit A and the one without slit B. The experiment will produce a particle-like distribution, even for the quanta which pass through slit B, which cannot possibly be influenced by the detector. It's as if merely the ability to know an outcome determines the nature of the outcome. This can be explained more or less classically if those quanta are indeed interacting with the detector across World Cross Sections. Or, more precisely, the Morphology of the quanta across all Worlds is modified by interactions with the detector in those Worlds where the quanta passes through slit A. Meanwhile, in experiments with no detector, quanta interact with their counterparts in adjacent Worlds to produce interference patterns.

Note that on close examination – and within the context of Block Time – most of the examples of quantum weirdness become, well…, not less weird, but a different kind of weird. These include "spooky action at a distance," the delayed choice quantum eraser, and the Stern-Gerlach variant with three analyzers (*z*,*x*,*z*) and beam recombination after the second one. In all of these, there are *local*, physical interactions with a detector of some sort at some point, and if Block Time is allowed then those interactions can be communicated across time and Worlds by the static structures of Morphologies. (Causally significant information is still not communicated faster than light, as usual.) The new weird is at least more or less classical in terms of locality, and within the multiverse as a whole, deterministic.

Consider also the intriguing possibility that Feynman diagrams represent real structures in Cross Sections of the World space. The relevant quantum fields for on-shell particles would occupy dimensions to satisfy their degrees of freedom, and perhaps sub-dimensions would extrapolate the degrees of freedom of virtual particles. All of these field components would have Morphologies, entirely real and eternal, and the resulting forces (static curvature effects) would arise from the combined influence of virtual particles across Cross Sections.

Observer Bias

Taking Block Time as real, the most directly observable consequence of cross sectional identity occurs in human consciousness, where in each temporal Cross Section of a person's world line, there is an

instance of that person perceiving themselves to be three dimensional and convinced that this moment is the one and only "now." In Block Time, time does not actually flow, so this collection of Cross Sections of consciousness are bound to this Observer Bias concerning which moment is now – each of them, eternally.

To speculate about the source of the illusion of flowing time, consider the discontinuous function $f(x) = (x^2 - 4) / (x + 2)$. This graphs as a straight line with a "hole" at $x = -2$, where the function is undefined. The missing range value (-4) can be found by taking the limit of $f(x)$ as x approaches -2 from both the left and right sides. Analogous to this use of limits, but without the hole, perhaps each instantaneous Cross Section of consciousness perceives the *infinitesimal* Cross Sections "adjacent" to it in its past and future. Each Cross Section would thereby perceive continuity and produce, eternally, the illusion of a flow of time. Note, however, that regardless of whether or not the illusory sense of flowing time can be explained, the mathematics of GR very strongly suggests Block Time. Like so many other concepts in physics, if it's true, it's true even if it is profoundly counter-intuitive.

Perhaps obviously then, the Permutations Conjecture assigns the perception of a singular universe to Observer Bias. This concept is already present in Everettian Many Worlds. The difference here is that the bias is driven by Cross Section of continuous or Planck incremented Morphologies, and not by decoherence or any other alternate version of wave function collapse. It is worth restating explicitly: the Permutations Conjecture does not appeal to, nor rely on, decoherence.

Duplicity

To the extent that an object can be described as three dimensional, its instantaneous mass-energy according to Block Time is only a Cross Section, a slice, of its four dimensional totality. Each Cross Section, then, has its own bit of mass-energy, which is more or less a copy, or duplicate, of adjacent Cross Sections – a nearly identical duplicate, but not the same mass-energy as reckoned instantaneously in three dimensions. However, there is of course continuity from one instant to the next, resulting in a neat world line and apparent conservation of mass-energy. For quanta, this instantaneous mass-energy is still "continuous" (Planck time incremented, but without gaps), but variable within the constraints of the uncertainty principle. The variance is a degree of freedom.

In the example permutations table, notice that in each cell in the first column in each layer, there is an 'A', for a total of nine 'A's. It is always an 'A', but it is a different 'A' each time. There is, then, Duplicity of 'A's. Note that there are information theoretic implications here, since while each 'A' is physically unique, they all contain the same information.

The Permutations Conjecture assigns the concept of branching Worlds to Duplicity. There is no actual branching or generation of new universes. Adjacent Worlds are individually eternal; but are simply completely identical, until such time that a particular change in a degree of freedom becomes relevant.

A Note About Scale

As if the number of branching nodes and individual Worlds in Everettian Many Worlds is not gihumongous enough, now here is this concept of a googol$^{\text{gihumongoussed}}$ number of dimensions required to physically extrapolate every degree of freedom, ever. Still, consider that not at all very long ago the

"Andromeda Nebula" was thought to be a nearby gas cloud, because the concept of galaxies did not fully exist; and not long before that people believed that the earth and some crystal spheres surrounding it were the entire universe. Meanwhile, we now have that mind blowing video simulation of zooming out from our Earth, to finally view the whole map of galaxy clusters (galaxy *clusters*! – many of them!) in the visible universe.

Our reckoning of the vastness of both the time and distance scales of reality has trended toward exponential growth. So has our reckoning of the sheer quantity of mass-energy in the universe, even when only baryonic matter is considered (including whatever baryons become after they enter a super massive black hole). We can formulate this understanding of scale as an observation – as a provisional assertion – that whatever the source of time, space, and mass-energy is, their creation is a trivial exercise for this source. (Referencing a source of creation in this manner is absolutely not in support of any of the old-religion gods; it is simply attaching a label to the concept of primary cause.) Creation of reality is evidently as trivial to the source as it is for us to dream of owning a mansion with one thousand rooms. If it is plausible for the universe to be infinite in extent, it is not that much larger of an infinity to consider it to be effectively infinite in dimensionality, whether in an Everettian or a Permutations Conjecture sense.

Conclusion

The interpretations of quantum mechanics are not physics, they are a first layer of philosophical abstraction based on the physics. Likewise, the Permutations Conjecture, as presented here, can not be considered physics, but is a second layer of philosophical abstraction. It is conceded to be useful only to the extent that it leads to falsifiable mathematical models. Still, the potential of philosophy in physical inquiry is perhaps drastically underestimated in modern academia – especially considering the current stalemate in attempts to derive the next breakthrough physics, based solely on reformulating the mathematics of the current GR/ QM duality. Keep in mind, for example, that Emmanuel Kant posited something like the existence of galaxies outside of our own, and the Greek philosophers posited something like atomic theory, long before either of these became physics.

Still, there *is* a mathematical approach clearly implied by the Permutations Conjecture. It features the handling of an arbitrarily large number of dimensions, geometrical descriptions of Morphologies in multiple dimensions, and meaningful Cross Sections of these. It may be that the current math does not even have the necessary tools yet, in the same way that Isaac Newton had to invent part of calculus (at least as far as he knew... hmphf... cough... Leibniz) to formulate his mechanics. In any case, it is hard to imagine mathematics related to the Permutations Conjecture occurring on a blackboard, but is more likely to find a home in powerful software, where AI enhancement may actually be good at figuring out Morphologies. Quantum computers – though mis-hyped by the media, with the false implication that they may result in faster computers as consumer products – may actually be ideally suited to the math of permutations. Indeed, under the Conceptual Framework, quantum computers can be construed as multi-World mechanisms, existing and operating across parallel universes.

The greatest barrier to fully understanding the Conceptual Framework (where not *agreeing* is just fine), is developing a deep intuitive sense of Block Time. Really, it all follows from there.

May all your otters be happy otters!